CLAIMS

1. An apparatus for measuring a constituent of a fluid, the apparatus comprising:

a vessel to contain the fluid;

a light source configured to direct a first band of light and a second band of light along a substantially shared path though the fluid in the vessel, wherein the constituent has a greater absorption associated with the first band of light than with the second band of light; and

a photosensor that senses the first band of light and the second band of light passing along the substantially shared path.

2. The apparatus of claim 1, wherein the fluid comprises ozonated water and the constituent is ozone.

3. The apparatus of claim 2, wherein the vessel comprises a delivery pipeline for the ozonated water to permit in situ measurement of the ozone.

4. The apparatus of claim 2, wherein the first band of light is associated with a yellow-red frequency and a first width, and the second band of light is associated with a blue frequency and a second width.

5. The apparatus of claim 4, wherein the light source comprises a yellow-red light-emitting diode to provide the first band of light, and a blue light-emitting diode to provide the second band of light.

6. The apparatus of claim 5, further comprising a second photosensor that senses the first band of light and the second band of light after they pass along at most a portion of the substantially shared path to detect differential aging of the light-emitting diodes.

7. The apparatus of claim 1, wherein the substantially shared path is defined in part by at least one reflection site to increase a length of the path through the fluid in the vessel, thereby increasing a measurement sensitivity for the constituent in the fluid.

8. The apparatus of claim 7, wherein the vessel comprises a material that defines an inner surface of the vessel that diffusely scatters the first and second bands of light at the at least one reflection site.

9. The apparatus of claim 7, further comprising a coating on an exterior surface of the vessel to provide diffuse scattering of the first and second bands of light at the at least one reflection site.

10. The apparatus of claim 1, wherein the constituent has an absorption band that overlaps the first band of light.

11. The apparatus of claim 1, wherein the light source comprises a light-emitting diode.

12. The apparatus of claim 1, wherein the vessel comprises a material selected from the group of quartz and a polymer.

13. The apparatus of claim 1, wherein the photosensor senses the first band of light and the second band of light after the first band of light and the second band of light pass along the substantially shared path.

14. The apparatus of claim 1, wherein the photosensor senses the first band of light and the second band of light as the first band of light and the second band of light pass along the substantially shared path.

15. The apparatus of claim 1, further comprising at least one of a temperature sensor, for measuring a temperature of the fluid in the vessel, and a pressure sensor, for measuring a pressure of the fluid in the vessel.

16. An ozonated water generator, comprising:

a contactor for mixing water and ozone gas;

a pipeline in fluid communication with the contactor for delivery of ozonated water to a process tool;

a light source configured to direct a first band of light and a second band of light along a substantially shared path though the fluid in the pipeline, wherein a constituent of the ozonated water has a greater absorption associated with the first band of light than with the second band of light; and

a photosensor that senses the first band of light and the second band of light after they pass along the substantially shared path.

17. A method for measuring a constituent of a fluid, the method comprising:

selecting a first band of light for which the constituent has a greater absorption than for a second band of light;

sensing the first band of light and the second band of light after they pass along a substantially shared path through the fluid; and

modifying a measured attribute of the constituent determined from the sensed first band of light in response to the sensed second band of light to improve the accuracy of the measured attribute.

18. The method of claim 17, wherein modifying comprises correcting the measured attribute for an intensity loss of the sensed first band of light associated with at least one factor other than absorption by the constituent.

19. The method of claim 18, wherein the at least one factor comprises at least one of bubbles, a reflectivity of a reflection site of the substantially shared path, an impurity in the fluid, and a mechanical dimension of a vessel containing the fluid.

20. The method of claim 17, further comprising providing the substantially shared path in a vessel.

21. The method of claim 20, wherein the substantially shared path is defined in part by at least one reflection site to increase a length of the substantially shared path in the vessel.

22. The method of claim 20, wherein the fluid is ozonated water, and further comprising causing the ozonated water to flow through the vessel from an ozonated water generator to a process tool to permit in situ measurement of the ozone concentration.

23. The method of claim 17, further comprising alternately directing the first band of light and the second band of light along the substantially shared path, wherein sensing comprises alternately sensing the first band of light and the second band of light.

24. The method of claim 22, wherein alternately directing further comprises alternately directing no light along the substantially shared path.

25. The method of claim 22, wherein further comprising sensing at least one of the first band of light and the second band of light along at most a portion of the substantially shared path, and responsively maintaining an emitted intensity of at least one of the first band of light and the second band of light.

26. A method for producing ozonated water having a desired ozone concentration, the method comprising:

selecting a first band of light for which the ozone has a greater absorption than for a second band of light;

generating ozonated water in a ozonated water generation device;

sensing the first band of light and the second band of light after they pass along a substantially shared path through the ozonated water after the ozonated water flows from the device;

modifying a measured ozone concentration determined from the sensed first band of light in response to the sensed second band of light to improve the accuracy of the measured ozone concentration; and

adjusting at least one parameter of the device until the measured ozone concentration substantially matches the desired ozone concentration.